



## ENHANCING STUDENT ENGAGEMENT THROUGH COMPETITION-BASED LEARNING IN REMOTE AND DIGITAL LEARNING ENVIRONMENTS

Michael McGuire

Glasgow Caledonian University, Scotland, UK

### Abstract

Traditional education models delivered remotely struggle to sustain student engagement. However, novel learning approaches are rarely adopted at scale due to institutional resistance, lack of structured implementation frameworks, and misalignment with existing curricula. This paper aims to examine the impact of competition-based learning through the integration of digital badges as motivational tools within a Virtual Learning Environment (VLE), to encourage self-paced, autonomous learning. Using a mixed-methods approach, quantitative data were collected through student performance tracking, and model accuracy measurements, alongside qualitative feedback from surveys. Findings indicate that achievement-driven incentives enhance student and educator motivation, engagement, and accelerate skill acquisition.

### Background

The COVID-19 pandemic accelerated the adoption of digital tools and Virtual Learning Environments (VLEs) in higher education. However, while online platforms ensured delivery continuity, andragogical innovation lagged. Many educators transferred existing materials into digital formats without adapting them for remote learning, limiting engagement and interactivity (Hodges et al., 2020). Hollister et al. (2022) found that 72% of students experienced reduced engagement and attendance in online lectures, highlighting the challenges of sustaining motivation in virtual settings.

This reflects a broader issue: While technology has changed content delivery, it hasn't transformed learning, students often remain passive consumers rather than active participants (Mohamed Hashim et al., 2021). Prior to the pandemic, the researcher observed that informal, competitive activities in their own classroom consistently increased student motivation, participation, and enjoyment. Recognising these effects, the researcher introduced competition-based learning (CBL) into a digital construction module during remote delivery, aiming to replicate the heightened engagement previously observed in face-to-face lessons.

CBL, though underexplored in digital construction, has demonstrated benefits in extracurricular studies. It is grounded in constructivist and experiential learning theories (Vygotsky, 1978; Daloz, 1986), and is well-suited to applied fields requiring practical skill development. Structured competition fosters intrinsic motivation and encourages learners to refine competencies through repeated, goal-driven challenges (Grant & Dweck, 2003; Ryan & Deci, 2020). Beyond external rewards, CBL can promote a mastery-oriented mindset (Ames & Archer, 1988; Ryan & Deci, 2020), enhancing sustained engagement and confidence (Hamari et al., 2014).

Competitiveness has been identified as a key driver of motivation (Grant & Dweck, 2003), particularly in contexts where individuals or teams strive for excellence. This effect is evident in the intrinsic motivation to practice a sport, where performance improvements are driven by the pursuit of victory (Frederick-Recascino & Schuster-Smith, 2003).

Despite the benefits, competition remain underutilised in higher education, often due to concerns about stress, lack of implementation frameworks, or institutional resistance (Burguillo, 2010). Yet research suggests that when high-challenge tasks are balanced with support, learners report increased resilience and motivation rather than anxiety (Daloz, 1986). In elite performance contexts, such as sport, anxiety is managed through structured support, and notably, recreational athletes often report enhanced well-being, indicating that competition is not inherently harmful (Li et al., 2024). Appropriately supported, CBL can create dynamic environments that foster enhanced engagement, participation and accelerated learning.

Initial implementation of CBL in online digital construction modules showed promising results. Students engaged more actively, progressed through modules faster, and demonstrated stronger collaboration and technical competency. When in-person learning resumed, the researcher reapplied the same CBL strategies using VLE-hosted materials, again observing improved engagement and accelerated learning. These outcomes highlighted CBL's potential as a flexible and effective

andragogical and heutagogical approach, meriting further investigation across broader educational contexts.

Since 2018, this study has expanded across multiple UK and institutions, involving 134 participants (122 students and 12 educators), across disciplines such as Architecture, Architectural Technology, Civil Engineering, Environmental Engineering and Quantity Surveying. Participants were selected through convenience sampling (Emerson, 2015), reflecting diverse educational levels and backgrounds. Their involvement enabled a comprehensive evaluation of the benefits and challenges of CBL in digital construction.

The study explored how competition can enhance student engagement, and skill development through motivation to master the practical application of theoretical knowledge. Through structured, performance-driven tasks, students were expected to:

- Demonstrate increased motivation to actively engage with learning activities and challenges.
- Accelerate the development of practically applied knowledge through iterative, feedback-informed tasks.
- Achieve measurable improvements in performance, reflected in higher average assessment scores and greater task proficiency.

This broader implementation provided insights into the scalability and adaptability of CBL across varied educational settings. It also allowed the researcher to explore how factors such as curriculum design, institutional support, and delivery methods shape the effectiveness of CBL. The findings offer a more comprehensive understanding of CBL's role as a scalable andragogical model within digital construction education.

By adopting a longitudinal, mixed-methods approach across multiple years, programmes and institutions, this study extends current research on digital Project-Based Learning (PBL) and CBL. Embedded within digital construction curricula and aligned with international industry standards, it incorporates performance-based digital badges and structured feedback to explore how competition supports mastery, intrinsic motivation, and accelerated learning. Unlike prior studies that frame competition as extracurricular activity, this research positions CBL as a core instructional strategy capable of enhancing engagement across both digital and in-person delivery models within mainstream construction lessons.

## Methodology and Task Description

This study employed a mixed-methods research design to investigate the impact of competition-based learning (CBL) in digital construction education. Integrating qualitative ethnographic techniques (Hammersley & Atkinson, 2009) with quantitative performance analysis, the research aimed to capture both the subjective experiences and objective outcomes associated with CBL. A quasi-experimental approach (Shadish et al., 2002) was adopted due to the absence of randomised control groups,

with naturally formed student cohorts serving as the primary units of analysis.

The qualitative component of the study drew on ethnographic and case study methodologies to explore learner engagement, motivation, and behavioural change over time. Longitudinal ethnographic observations allowed the researcher, acting as both educator and participant observer to document real-time student interactions and responses during CBL activities. Structured observation protocols were used to track indicators such as collaboration, problem-solving strategies, and shifts in motivation. The extended duration of the study, spanning multiple academic years and cohorts, enabled the identification of long-term behavioural patterns often overlooked in short-term evaluations.

The ethnographic work was embedded within a broader multi-case study framework, enabling the investigation of CBL implementation across several contexts. Each case reflected a distinct student cohort and included a rich dataset comprising student outputs, assessments, structured observations, educator reflections, and student feedback. This approach facilitated an in-depth understanding of the contextual factors shaping learner behaviour and performance. Drawing on Stake's (1995) perspective, the case study method allowed for a holistic examination of how CBL influenced both teaching practices and student learning experiences in authentic, practice-based settings.

To complement the qualitative data and ensure analytical rigour, quantitative performance analysis was conducted using student assessment data. Task-based assessments, designed in collaboration with industry partners, were aligned with real-world digital construction challenges. These assessments were evaluated using standardised rubrics to ensure consistency and objectivity. Pre- and post-intervention comparisons were made to assess learning gains, while time-on-task metrics offered additional insights into changes in efficiency and productivity. Descriptive statistics were used to identify overall trends, and inferential statistical methods were applied where appropriate to evaluate the significance of observed differences.

By triangulating multiple data sources, including structured observations, student assessments, and participant reflections, this mixed-methods design provided a comprehensive understanding of the effectiveness of CBL. The integration of qualitative insights with quantitative metrics ensured a robust, multi-dimensional perspective on how competition-based learning shapes educational outcomes in digital construction.

CBL elements were introduced progressively across modules to enable controlled evaluation. These elements included timed technical challenges that simulated industry tasks, competitive activities in both individual and team formats, and leaderboard ranking systems designed to encourage motivation through structured feedback. Following each competition, structured debrief

sessions were held to capture student reflections and qualitative feedback. This iterative structure enabled continuous refinement of the CBL format to improve engagement and learning outcomes.

To strengthen the study's validity, triangulation was employed at multiple levels. Data triangulation involved comparing performance metrics with ethnographic observations and student reflections, while methodological triangulation combined qualitative approaches (e.g., observations and questionnaires) with quantitative data (e.g., performance scores). Investigator triangulation further supported objectivity by involving multiple educators and industry professionals in reviewing findings and reducing potential researcher bias. Nonetheless, some limitations should be acknowledged. Due to the educational context, the study did not include a fully randomised control group. Observer bias, while mitigated through structured observation protocols and investigator triangulation, remains a consideration. Additionally, variability in students' prior experience and skill levels posed challenges; however, this was addressed through pre-assessment benchmarking and differentiated task design.

The Virtual Learning Environment (VLE) served as an essential delivery mechanism, providing students with scaffolded, self-paced 3D modelling tasks in Revit (Figure 1), Navisworks Manage and the Autodesk construction cloud while working to ISO19650 standards. Exercises increased in complexity over time and were underpinned by Daloz's (1986) Theory of Transformative Learning. This approach balanced support to the challenge, enabling learners to progress confidently while engaging in authentic design tasks aligned with the CBL goals and module intended learning outcomes (ILOs).



Figure 1: 3D model competition presented via the VLE

A key feature of the study was its VLE hosted automated scoring and feedback, which assessed students' models using predefined tolerances. Points were awarded based on the precision of their work, ensuring objective and consistent evaluation. The system provided immediate feedback, identifying specific areas where students demonstrated strengths and weaknesses and directing them to targeted learning resources for improvement. This immediate and structured feedback mechanism prevented students from reinforcing incorrect practices (Hattie, 2008) and guided them toward mastery of workflows.

To address the challenge of assessing complex 3D models in a scalable and objective way, an automated scoring system within the VLE was initially implemented as a self-assessment quiz (Figure 1). Students used Revit's built-in schedules and properties tools to extract values from their models, such as element count, length, area and volume, which reflected the accuracy and completeness of their work. These values were manually entered into a VLE-hosted quiz interface by the student themselves.

Upon submission, an automated scoring, written in Maple programming language (Figure 2) compared each student's value against predefined benchmark values derived from a reference model. Tolerances were built into the marking to account for minor acceptable deviations, and partial marks were awarded based on proximity to the target values. Instant feedback was provided, highlighting correct tasks, areas for improvement, and directing students to relevant resources to support them on their learning journey.

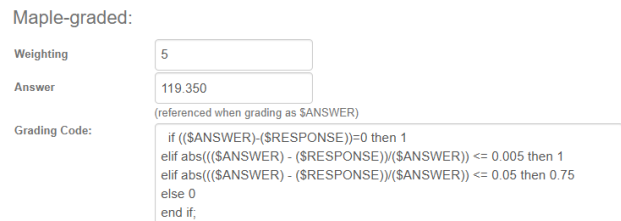


Figure 2: Screenshot of the maple marking rubric

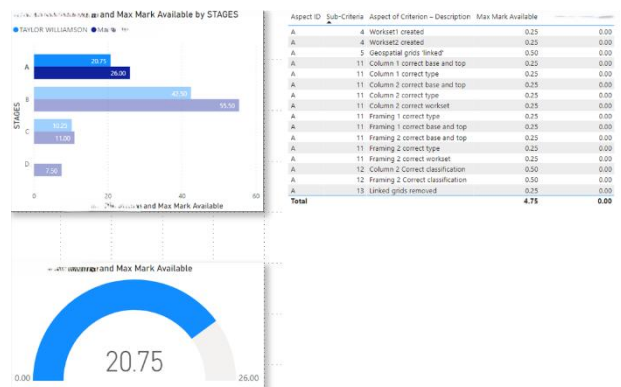


Figure 3: The automated scoring generated a power-bi report

By semi-automating the marking, students received instant performance scores and feedback (Figure 3) rather than waiting for manual grading, enabling them to iterate and refine their models more efficiently in the same session. The ability to repeatedly attempt exercises, compare their work against the researcher-created reference model, and receive real-time, personalised feedback fostered a cycle of continuous improvement. This approach not only enhanced engagement but also aligned with high-support, high-challenge learning, reinforcing competence, confidence, and skill acquisition.

A similar process was used to mark the assignment or test project. Within the Revit files provided to the students, there were pre-built schedules which automatically populated as the students created the 3D model. These schedules were used to interrogate the model against the

same criteria as the exercises such as model completeness and accuracy.

The immediate availability of scoring and feedback within the VLE led to a noticeable increase in student engagement and practice frequency. Many students repeated exercises multiple times in one sitting despite having passed the exercise, motivated by the desire to improve their scores. Some engaged in self-competition, aiming to beat their previous best, while others competed informally with peers, comparing scores, and striving for higher levels of accuracy and efficiency.

This implementation of competition into lessons resulted in students developing software proficiency at an accelerated pace, as they actively sought to improve their score, they refined their techniques through continuous iteration and targeted feedback. This rapid progression not only enhanced their mastery of Building Information modelling (BIM) process knowledge but also enabled the practical application of this knowledge through increasingly complex 3D modelling tasks. As a consequence, the original assessment tasks and test projects became insufficiently challenging, revealing an unexpected outcome: students were achieving levels of proficiency far earlier in the term than expected, necessitating a revision of exercise and assessment design to maintain appropriate levels of cognitive demand.

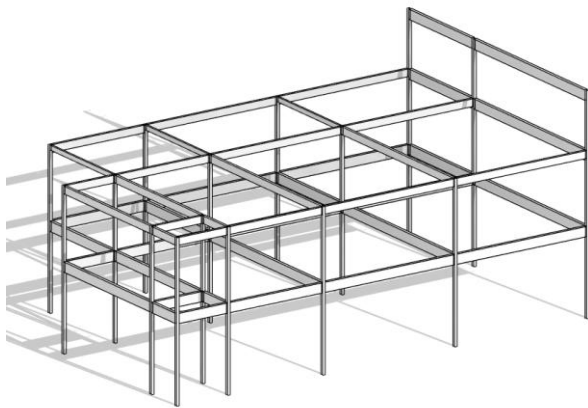


Figure 4: 2019 test project was considered overly complex at the time for the 1-hour time allocation

A gradual increase in project complexity over time served as a clear indicator of student improvement and accelerated skill acquisition. What was initially considered overly complex in 2019 (Figure 4) for a one-hour assignment was, within a few cycles, completed with increasing confidence and accuracy. To maintain an appropriate level of challenge and support continued development, the test project was deliberately expanded (Figure 5), incorporating more advanced modelling requirements, additional parametric constraints, and stricter accuracy tolerances, all within the same one-hour time frame. This evolution not only reflected the growing competence of learners but also demonstrated the effectiveness of CBL in driving rapid progression. Students remained highly engaged, continuously challenged, and motivated to perform at higher levels, reinforcing the value of competition-based learning in

accelerating technical proficiency and deepening their understanding of digital construction practices.

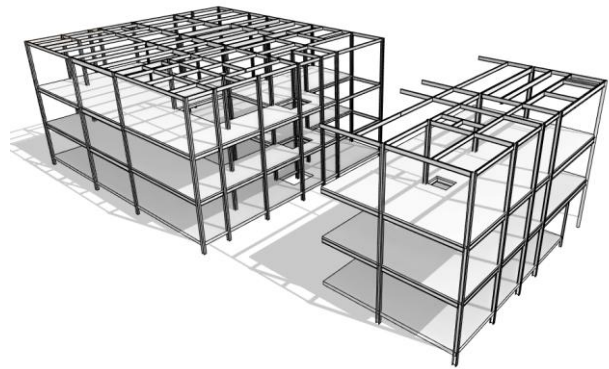


Figure 5: 2024 larger and more complex test project was required to keep challenging students

The inclusion of a performance score in a digital badge upon successful completion of an exercise fostered a drive for mastery, where the motivation to improve extended beyond merely passing. The pass mark was set at 40% in alignment with standard undergraduate pass criteria used in UK higher education. While this threshold indicated a minimum level of understanding, it was not presented as a mark of full competence. Instead, it served as a starting point within a mastery-based framework, where students were encouraged to continue practicing and improving. As a result, instead of progressing to the next exercise, every student who reached this benchmark chose to keep working toward the highest possible score, motivated by the visibility of performance within the digital badge (Figure 6).

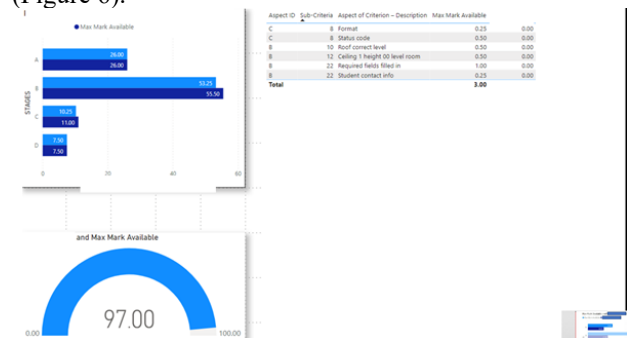


Figure 6: Students reattempted the same exercise several times despite having achieved a pass

This behaviour highlights the causal relationship between structured feedback, competition, and increased practice, reinforcing the positive impact of competition-based learning on engagement, and performance improvement in digital construction education.

As part of a growing community of practice committed to enhancing digital construction education, the researcher collaborated with industry partners to co-develop improved methods of assessment, benchmarking and feedback that could be shared and scaled across institutions. Recognising the challenges educators faced in consistently and objectively evaluating increasingly complex 3D models, this community focused on developing automated workflows to reduce marking

burdens, increase consistency, and improve the student learning experience. A key output of this collaboration was the development of external scripts designed to reflect real-world model audit procedures used in industry.

In industry, these scripts enabled systematic model audits by checking predefined standards across a broad range of elements, such as measurements of quantities, areas, volumes, and workset use. The key benefit of employing this approach in the study was its ability to automatically inspect the entire model, rather than relying on sampling a few of each element. This ensured a holistic evaluation of modelling quality and increased the reliability of assessment data, especially when managing large cohorts or high-frequency assessment points.

Students were provided these model checker scripts and able to run them independently within their Revit model, generating a real-time 'model health score' which identified areas for improvement. The score served as a formative indicator of model accuracy, structure, and compliance with digital construction standards such as ISO19650. Strengths were acknowledged with green tick symbols, while deficiencies, such as missing parameters, or incorrect element properties or values, were highlighted as red 'X' symbol with actionable guidance. The underlying benchmark model, pre-constructed by the researcher, acted as the reference standard against which student models were evaluated. This allowed for objective, repeatable assessments and enabled students to work iteratively on their models with clarity and purpose.

Over time, and in line with industry practices, the assessment process evolved to incorporate Solibri and the use of open standards via IFC (Industry Foundation Classes) exports from Revit. This progression aligned more closely with the workflows employed by architectural, engineering, and construction firms, where Solibri is routinely used for model validation, coordination, and compliance checking, especially on large-scale or multidisciplinary BIM projects. By transitioning to Solibri, students were able to run more sophisticated rule-based checks that transcended software-specific constraints. Solibri's robust rule set enabled evaluation against industry standards such as COBie (Construction Operations Building information exchange) completeness, spatial coordination, duplicate detection, and compliance with classification system Uniclass 2015.

This shift also offered andragogical advantages. It exposed students to the same Quality Assurance / Quality Control (QA/QC) tools used in professional environments, fostering authentic learning experiences and enhancing industry readiness. From a technical perspective, using Solibri allowed models to be assessed in a neutral, platform-independent format (IFC), encouraging best practices in interoperability and open BIM. In doing so, the assessment process became not only more comprehensive and scalable but also more aligned with real-world digital construction workflows,

reinforcing the bridge between academic learning and professional expectations.

To further evaluate CBL's impact, Likert (1932) scale questionnaires were shared with both students and educators seeking more meaningful insights of the causality behind the quantitative scores. Qualitative data was collected by collecting feedback from 15 educators and 25 students from the 2023 and 2024 cycles. Alongside observations and discussions, questionnaires were used to collate perceptions of the CBL approach, including its impact on skill development, engagement, and the learning experience. This qualitative data helped contextualise the numerical results, offering a richer understanding of how competition influenced motivation, learning outcomes, and the overall effectiveness of competition to drive motivation and improve learning outcomes.

The questionnaire design for this study followed established best practices in educational research, drawing on guidance from Artino et al. (2014), Denscombe (2010), and others to ensure clarity, relevance, and effective data collection. Likert's (1932) psychometric scale was employed to quantify subjective attitudes and opinions, allowing respondents to express agreement or disagreement across a five-point scale, with optional open-ended responses for additional detail. To enhance accessibility and response rates while minimising respondent fatigue, the questionnaire was structured to align with Denscombe's (2010) recommendation to maintain brevity and logical sequencing. Google Forms was selected as the distribution platform, eliminating logistical constraints and enabling participants to complete the survey at their convenience, which Dillman (2014) suggests can lead to more reflective and honest responses. To further reduce social desirability bias, responses were anonymised, and WorldSkills UK facilitated questionnaire distribution, creating a layer of separation between the researcher and respondents ensuring greater respondent confidence in anonymity, ultimately improving the authenticity of the data collected. Participants were asked:

On a scale of 1 to 5 (5 being most) how effective do you believe Competition-Based Learning when compared to traditional education methods was in the following areas:

Q1: accelerate you / your student's learning and skill acquisition?

Q2: help you / your student's grasp complex concepts more quickly?

Q3: help you / your student's knowledge retention of complex concepts?

Q4: make learning more interesting for you / your students?

Q5: engage you / your students more in lessons?

Q6: develop you / your student's critical thinking and problem solving?

Q7: prepare you / your student's for progression to further studies or industry?

Q8: develop you / your student's knowledge and understanding of a subject to a deeper level?

Q9: have a positive impact on your student's confidence and self-belief?

Q10: have a negative impact on you / your student's confidence and self-belief?

## Results

This study investigated the impact of Competition-Based Learning (CBL) on engagement, motivation, and skill acquisition in digital construction education. The findings indicate that CBL not only improved student engagement but also accelerated the development of technical proficiency. A mixed-methods analysis combining longitudinal performance data with ethnographic observations, educator reflections, and structured student feedback revealed consistently positive outcomes across multiple cohorts.

Quantitative assessment data from 2018 to 2024 showed a significant increase in student scores (Figures 7 and 8), despite a corresponding rise in task complexity. By 2024, students were completing 3D models four times larger and more intricate than those from earlier years (Figures 4 and 5), yet continued to achieve high accuracy under time constraints. This suggests that CBL not only maintained but enhanced technical performance under increasing cognitive load. The adoption of a granular marking scheme (Figure 9), which rewarded speed only when accuracy was preserved, reinforced the development of precise, efficient modelling techniques.

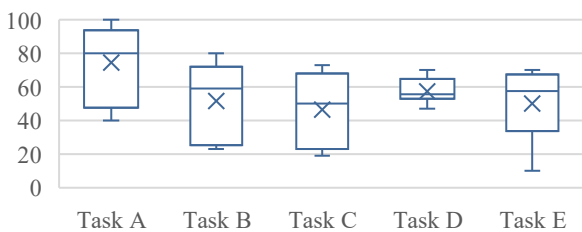


Figure 7: 2018 performance scores

Despite the higher challenge level (Figure 5), performance scores rose steadily, indicating that students acquired skills more rapidly through structured competition. The narrowing standard deviation in results (Figures 7 and 8) further suggests improved consistency in outcomes across learners. This pattern aligns with existing literature on gamification and mastery learning, which emphasises the motivational impact of structured, competitive tasks as an extra-curricular activity (Hamari et al., 2014).

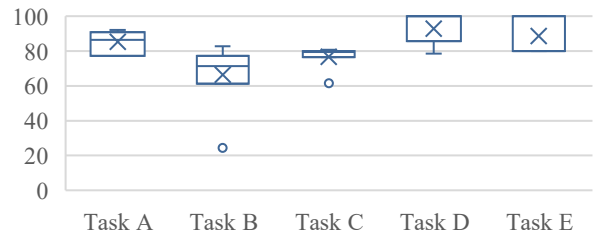


Figure 8: 2024 performance scores

To contextualise the quantitative data, Likert-scale questionnaires were distributed to both students (n=25) and educators (n=15) during the 2023 and 2024 cycles. The surveys explored perceptions of CBL's effectiveness across areas such as learning speed, understanding, retention, engagement, and confidence. The response rate was 75.47%, exceeding the 70% benchmark considered strong for reliability and representativeness (Baruch & Holtom, 2008; Dillman, 2014).

Students reported that CBL made learning more enjoyable and challenging (Figure 9), shifting their perception from passive attendance to active problem-solving. Most respondents believed that the competitive structure accelerated their learning and helped them retain complex concepts. Importantly, concerns about negative psychological effects were minimal, with most students reporting little or no stress. On the contrary, many noted increased confidence and resilience, crediting the structured feedback and opportunity for iterative improvement.

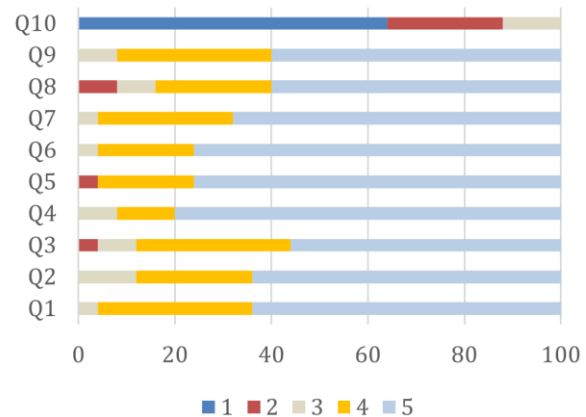


Figure 9: Students' responses

Educators observed similar trends (Figure 10). They reported increased participation, higher attendance, and more focused engagement in lessons. While 40% noted some instances of anxiety among students, follow-up discussions clarified that this was more accurately described as excitement or performance pressure, an expected feature of authentic, real-world tasks. Overall, educators perceived the CBL approach as a well-supported and effective strategy for enhancing technical learning.

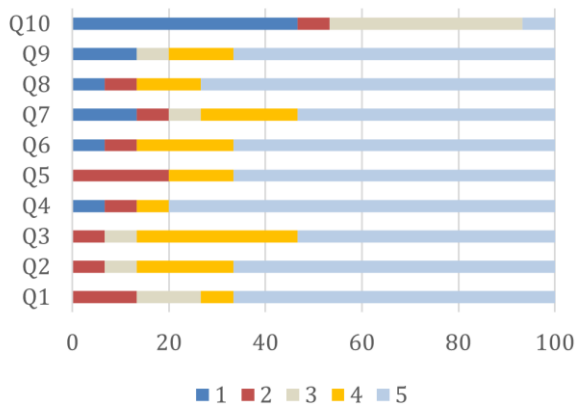


Figure 10: educators' responses

The integration of an automated scoring system within the VLE played a pivotal role in supporting rapid skill development. Student submissions were compared to reference models built by the researcher, and assessed using pre-defined accuracy tolerances. The system generated Power BI dashboards (Figure 3), offering real-time, itemised feedback and directing students to specific learning resources. This enabled learners to immediately correct errors, repeat exercises, and reinforce accurate techniques without waiting for manual grading.

The immediacy of feedback promoted a cycle of self-directed improvement. Students often repeated tasks within a single session, motivated by score improvement and informal peer comparison. This practice-based engagement significantly contributed to accelerated proficiency. As a result, earlier test projects were deemed too simplistic by later cohorts, leading to the design of more complex challenges to maintain cognitive demand (Figures 4 and 5).

Digital badges were used to recognise achievement, with performance scores driving motivation. Although the pass threshold was set at 40% in line with UK higher education standards, this minimum served as a starting point rather than a benchmark of competence. Most students continued to refine their work, aiming for higher scores, a behaviour indicative of mastery-oriented motivation driven by visible feedback and competition-based learning (Figure 6).

While CBL showed strong benefits, some challenges were noted. A minority of students (12%) reported moderate stress, often linked not to the competition itself, but to its delivery as an extracurricular activity that added workload. Educators also highlighted that CBL required more preparation, facilitation, and planning. However, the implementation of automated feedback and structured digital resources helped offset this time investment by reducing manual marking and increasing instructional efficiency.

Several limitations affect the interpretation of these findings. The relatively small sample sizes and the focus on a specialised programme limit generalisability. Although performance data spans seven years, qualitative feedback was collected only from the most recent cohorts.

Furthermore, self-reported data may be subject to bias. Despite anonymity and third-party distribution (via WorldSkills UK), further studies incorporating external observation, larger samples, and consistent longitudinal feedback are recommended to validate and expand these results.

Finally, differences in how individual educators implemented CBL may have influenced student experiences. Future research should explore more standardised frameworks and investigate how various learner profiles respond to competition. The psychological dimensions of competitive learning—particularly its effect on self-confidence and anxiety—also warrant further study, ideally in collaboration with performance coaches or educational psychologists.

## Conclusion

This study has demonstrated that competition-based learning (CBL) serves as a powerful catalyst for student engagement in mainstream digital construction education. The findings indicate that integrating CBL into technical education environments significantly enhances motivation, engagement, accelerated learning, and knowledge retention, aligning with constructivist and experiential learning theories. By embedding competitive elements into learning, students experience an accelerated learning curve, caused by the increased practice, however driven by the motivation to improve their own score or their peers.

The implementation of CBL as an educational methodology serves as a motivational bridge between traditional andragogical approaches and digital delivery, providing a structured yet adaptive framework for enhancing engagement and skill development in digital construction education. The results highlight that competition fosters a deeper level of engagement, particularly when combined with incentives such as digital badges and scoreboards. During this study, students exhibited not only greater technical proficiency at all stages, however they also improved their collaboration, resilience, and adaptability, skills that are crucial for success in any discipline.

The overwhelmingly positive feedback from both students and educators on the study, highlights its potential as a transformative approach. This strong reception supports a shift towards more dynamic, engagement-driven methodologies in digital construction education, reinforcing the value of structured competition in enhancing learning outcomes.

Despite the overwhelmingly positive outcomes, the study acknowledges that CBL must be carefully designed to mitigate potential challenges such as anxiety or hyper-competitiveness. The findings suggest that shifting the focus from winning to self-improvement and mastery, fosters a healthier competitive environment. By emphasising balanced support, clear evaluation criteria, and scaffolded learning experiences, students are encouraged to measure progress against their own performance rather than seeking to win, promoting intrinsic motivation and personal growth.

Future research should explore long-term effects of CBL, scalability across different educational settings, and its adaptability to diverse learning styles. Further investigation into fully automated performance tracking, AI-driven feedback systems, and gamified assessment methodologies could provide deeper insights into optimising CBL for digital construction education.

## References

- Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology*, 80(3), pp. 260–267. <https://doi.org/10.1037/0022-0663.80.3.260>
- Artino, A. R., La Rochelle, J. S., Dezee, K. J., & Gehlbach, H. (2014). Developing questionnaires for educational research: AMEE Guide No. 87. *Medical Teacher*, 36(6), 463–474. <https://doi.org/10.3109/0142159x.2014.889814>
- Baruch, Y., & Holtom, B. C. (2008). Survey response rate levels and trends in organizational research. *Human Relations*, 61(8), 1139–1160. <https://doi.org/10.1177/0018726708094863>
- Burguillo, J. C. (2010). Using game theory and competition-based learning to stimulate student motivation and performance. *Computers & Education*, 55, pp. 566–575. <https://doi.org/10.1016/j.compedu.2010.02.018>
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (3rd ed.). Sage Publications, Inc.
- Daloz, L. (1986). *Effective teaching and mentoring*. San Francisco: Jossey-Bass.
- Denscombe, M. (2010). *The Good Research Guide for Small Scale Research Projects* (4th ed.). Open University Press.
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed mode surveys: The tailored design method* (4th ed.). John Wiley & Sons Inc.
- Grant, H., & Dweck, C. S. (2003). Clarifying Achievement Goals and Their Impact. *Journal of Personality and Social Psychology*, 85(3), pp. 541–553. <https://doi.org/10.1037/0022-3514.85.3.541>
- Hamari, J., Shernoff, D. J., Rowe, E., Coller, B., Asbell-Clarke, J., & Edwards, T. (2014). Challenging games help students learn: An empirical study on engagement, flow, and immersion in game-based learning. *Computers in Human Behavior*, 54, pp. 170–179. <https://doi.org/10.1016/j.chb.2015.07.045>
- Hammersley, M., & Atkinson, P. (2019). *Ethnography: Principles in Practice* (4th ed.). Routledge. <https://doi.org/10.4324/9781315146027>
- Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses related to achievement*. Routledge.
- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The Difference Between Emergency Remote Teaching and Online Learning. *EDUCAUSE Review*, 27. Available at: <https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning>
- Hollister, B., Nair, P., Hill-Lindsay, S., & Chukoskie, L. (2022). Engagement in Online Learning: Student Attitudes and Behavior During COVID-19. *Frontiers in Education*, 7. <https://doi.org/10.3389/educ.2022.851019>
- Li, J., Leng, Z., Tang, K., Na, M., Li, Y., & Shah Alam, S. (2024). Multidimensional impact of sport types on the psychological well-being of student athletes: A multivariate investigation. *Heliyon*, 10(11), e32331. <https://doi.org/10.1016/j.heliyon.2024.e32331>
- Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology*, 22 140, 55.
- Mohamed Hashim, M. A., Tlemsani, I., & Matthews, R. (2021). Higher education strategy in digital transformation. *Education and Information Technologies*, 27(3), 3171–3195. <https://doi.org/10.1007/s10639-021-10739-1>
- Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices, and future directions. *Contemporary Educational Psychology*, 61, Article 101860. <https://doi.org/10.1016/j.cedpsych.2020.101860>
- Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton, Mifflin and Company.
- Stake, R. E. (1995). *The art of case study research*. Sage Publications, Inc.
- Vygotsky, L. S. (1978). *Mind in society: Development of higher psychological processes*. Edited by M. Cole, V. John-Steiner, S. Scribner, and E. Souberman. Harvard University Press. Available at: <https://www.jstor.org/stable/j.ctvjf9vz4>